INSTRUCTION MANUAL

PLUG-IN UNIT
TYPE 1340
1.0 MHz

SERIAL NO. 102...

SPEC 5248

INSTRUMENTS • AMPLIFIERS • NOISE INSTRUMENTATION

INSTRUCTION MANUAL

PLUG-IN UNIT
TYPE 1340
1.0 MHz

SERIAL NO. 102...

SPEC 5248
SER #102

QUAN-TECH LABORATORIES, INC.

43 So. Jefferson Road Whippany, New Jersey 07981

201-887-5508

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## CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. Include model number and serial number when referring to this instrument for any reason.

## WARRANTY

Quan-Tech Laboratories, Inc. warrants each instrument manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replace any defective parts thereof. Electronic tubes and batteries are specifically excluded from any liability. This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and when upon our examination it is disclosed to our satisfaction to be defective. If the fault has been caused by misadjustments, misuse, or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

Calibration checks of this instrument can easily be made in accordance with the instruction manual. Routine readjustments should never be attempted. If, however, the instrument has been damaged and requires recalibration or alignment, explicit calibration procedures as defined in the instruction manual must be followed.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty, and include the model number and serial number. On receipt of this information, we will give you service data or shipping instructions.
2. On receipt of shipping instructions, forward the instrument prepaid, to the factory. If requested, an estimate of the charges will be made before the work begins provided the instrument is not covered by the warranty.

## SHIPPING

The instruments should be packed in their original containers, or in a strong exterior container and surrounded by two inches of shock absorbing material.

Quan-Tech LABORATORIES

43 SOUTH JEFFERSON ROAD WHIPPANY, NEW JERSEY 07981

201-887-5508

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## A. DESCRIPTION

The Type 1340, 1.0 MHz Plug-in Unit is designed for use with the Model 340 Transistor Noise Analyzer to permit rapid measurement of transistor noise figures at 1.0 MHz. The instrument is self-calibrating for base resistances of 50, 100, 200, 500, 1K, 2K and 5K ohms.

## B. SPECIFICATIONS *

| | |
|---|---|
| NOISE FIGURE: | Measured directly in db in two meter ranges, 0-20db and 20-40db, for base resistances of 50, 100, 200, 500, 1K, 2K and 5K ohms. |
| COLLECTOR VOLTAGE: | Adjustable 1v to 60v with either polarity. Full scale meter ranges of 3, 10, 30 and 60 volts. |
| COLLECTOR CURRENT: | Adjustable from .01 to 30 milliamperes. Full scale meter ranges of .03, 0.1, 0.3, 1, 3, 10 and 30 milliamperes. |

* When used with the Model 340 Transistor Noise Analyzer

| | |
|---|---|
| SIZE: | 9"w x 5½"h x 11"d. |
| WEIGHT: | 7½ lbs. |

## A. OPERATION

1. Plug the Type 1340 head into the Model 340 front panel and tighten the two locking thumb screws provided.

2. Select the desired base resistance by means of the BASE RESISTANCE switch. Set the desired operating conditions and transistor type on the Model 340 (see manual).

3. Insert transistor to be tested in the front panel socket and close the shield cover, activating base and collector interlock switches. If the higher base resistances are selected, tune the CAPACITY control on the test jig panel for a maximum noise figure and minimum AGC meter indication. For the lower values of base resistance, the setting of the CAPACITY control is unimportant.

4. No further adjustment of the Type 1340 is required. Noise figure is indicated directly in db on the Model 340.

## A. GENERAL

1. The Type 1340, 1.0 MHz Plug-in Unit is basically the RF section of a single conversion superhetrodyne receiver, having its own calibrating and mixing signals necessary to convert the noise and calibrating signals from 1.0 MHz to the frequency spectrum of Ø to 50 KHz. Here the necessary signals are separated and displayed by the Model 340 Analyzer.

2. All power and control signals are supplied by the Model 340. The Block Diagram and Schematic Drawings show the basic connections and will enable the reader to follow the individual circuit descriptions that follow.

## B. TEST TRANSISTOR CIRCUITRY

1. To enable the direct reading of transistor noise figure, the total noise output must be referenced to the thermal noise of the transistor source resistance. The reference is done by maintaining a constant amplifier gain, independent of the operating parameters of the transistor under test. Constant gain is accomplished by inducing a fixed, known calibrate signal in the emitter of the transistor under test. The level of the 1.020 MHz calibrate signal is changed for each value of resistance selected by the BASE RESISTANCE switch S1A to maintain an overall amplifier gain inversely proportional to the thermal noise of the base resistance selected.

2. L1 and C2 are used to tune out the reactive component of the base circuitry and present a low impedance DC path for the base bias current.

3. The test transistor collector connects to a broad band current transformer T2. T2 serves to supply a low impedance path for the DC collector current and the AC noise and calibrate signal to the first 1.0 MHz amplifier.

4. Interlock switches S2A, S2B and discharge paths R1 and R9 are provided to remove operating potentials from both base and collector of the test transistor when the hinged shield cover is opened.

## C. 1.0 MHz AMPLIFIER

1. The operating level of Q1, the first amplifier, is selected for optimum noise figure. Q1 is operated in a grounded base configuration to provide maximum isolation and a low input impedance for the test transistor collector circuitry. R12 determines the current in Q1. T3 and C5 tune the collector to 0.939 MHz and supply an amplified noise and signal current to the following amplifier. C6 is a DC blocking capacitor, and C4 a collector return bypass capacitor. Bandwidth of the collector circuit is determined by the primary/secondary impedance ratio of T3, resistors R13, R14 and to some extent by the current in CR1. Gain is determined by the AC current division paths offered by R14 and CR1 to the current from T3 secondary winding. Gain control is achieved by passing a DC current through CR1, reducing the impedance of CR1, causing more of the signal and noise to be diverted to ground. In order to maintain system noise at a minimum for low Gm conditions of the test transistor, the AGC current to the first two stages is made ineffective until the AGC voltage exceeds approximately 2 1/2 volts. As the test transistor Gm increases, AGC control current increases through CR2, R15,CR1, R13, T3 to ground. The DC current lowers the AC impedance of CR1 and shunts some of the noise and signal current to ground through C8, resulting in reduced amplifier gain.

2. The second amplifier operates in a similar manner except that the collector circuit C10 and T4 are resonated at 1.061 MHz forming the second circuit of a maximally flat staggered Butterworth pair having a -3db bandwidth of approximately 170 KHz.

3. The third and fourth amplifier sections operate in a similar manner. The third being resonated at 0.939 MHz and the fourth at 1.061 MHz.

4. The fifth and sixth amplifier stages are similar but are fixed in gain. The fifth resonated at 0.939 MHz with bandwidth determined by R38 and the sixth resonated at 1.061 MHz with bandwidth determined by R73. The overall amplifier operating as three cascaded, maximally flat Butterworth staggered doublets. The overall -3db bandwidth is approximately 120 KHz.

D. 1.020 MHz CALIBRATE SIGNAL

1. The calibrate signal is generated by Q8 operating in a grounded base configuration. Transistor current is limited by emitter resistor R48. The quartz crystal Y1 operates in a series resonant mode and derives feedback current from the collector tank circuit C36 and T9. A center tap on the output winding of T9 supplies drive current to the emitter of buffer/amplifier Q9. Q9 is supplied with sufficient drive to operate class "C". The output from T10 is directly proportional to Q9 collector supply voltage. Collector supply voltage for Q9 is obtained from the voltage divider R56 through R63 as selected by the BASE RESISTANCE switch S2B. The ratios of the divider are adjusted to supply a calibrate signal level proportional to the thermal noise voltage of the test transistor base resistance selected. The calibrate signal from T10 is further attenuated by the shielded variable attenuator module R53, R54 and R55. Attenuator output drives the shielded 100:1 ratio calibration signal transformer T1 located in the emitter of the test transistor. The signal level from T1 is directly related to the BASE RESISTANCE switch and varies from 17 microvolts for the 50 ohm position to 170 microvolts for the 5K ohm position.

E. 1.000 MHz LOCAL OSCILLATOR SIGNAL

1. The local oscillator signal is generated by Q10 operating in grounded base configuration. Transistor current is limited by emitter resistor R66. The quartz crystal Y2 operates in a series resonant mode and derives feedback current from collector tank circuit C49 and T11. A center tap on the output winding of T11 supplies drive current to the emitter of buffer/amplifier Q11. Q11 is supplied with sufficient drive to operate class "C"; the output being determined by the regulated 15v power supply. The output winding on T12 supplies drive to the emitter of mixer transistor Q7 via the highly selective series resonant circuit L5 and C59.

F. MIXER AND LOW PASS FILTER

1. Q7 operates as a conventional high level mixer, the local oscillator signal injected in the emitter being much larger than the maximum noise and calibrate signal driving the base. The linearity of this mixer is excellent to well above 2 volts RMS output. The converted 20 KHz calibrate signal is maintained at a constant 0.25 volt RMS level by the AGC system, providing a large noise overload capability.

2. The collector of Q7 feeds a three pole maximally flat Butterworth low pass filter with cutoff frequency of 50 KHz, thus passing the noise and calibrate signal components below 50 KHz while rejecting all other noise and carrier components above 50 KHz. The output noise and AGC carrier signal go to the Model 340 for separation and metering

## G. NOISE FUNDAMENTALS

The Type 1340 unit is a frequency converting or mixing system with essentially a zero center frequency IF; therefore noise sidebands on both sides of 1.000 MHz (the local oscillator frequency) are converted to a folded or superimposed spectrum extending from zero frequency to the cutoff frequency of the low pass filter. As the noise bandwidth of the RF amplifier is very wide (approximately 120 KHz), allowing both sidebands to be converted, the effective noise per Hz of bandwidth below 50 KHz will be 3db greater due to the second sideband than an equivalent bandwidth at 1.0 MHz before converting. However, only one sideband of the calibrate signal is used i.e. the difference frequency of the two crystals 1.020 MHz - 1.000 MHz. The result is a noise to calibrate signal ratio from the mixer 3db greater than the noise to calibrate signal ratio for the same bandwidth at the test transistor input. The above facts must be realized if attempts are made to calibrate the system by the known gain known bandwidth approach.

SECTION 4

MAINTENANCE AND CALIBRATION

## A. GENERAL

1. The design of the Type 1340 is straightforward, employing rigorously screened long life semiconductors. Preventive maintenance is not required. Trouble shooting, if required, may readily be done in sections as indicated in the Block Diagram and Schematic Diagram. Standard transistor servicing care should be used throughout.

2. The components and transistors in the Type 1340 are conservatively rated and should provide long and trouble free service. Circuits are designed to minimize effects of any changes in semiconductor parameters.

3. Do not change any adjustments without a thorough knowledge of the circuit and function of the adjustment.

4. Transistors can be easily damaged with large transient voltages, therefore take great care not to short any terminals or conductors when making measurements on the printed circuit boards. In soldering to the boards, have the iron only hot enough to make a rapid clean solder joint. Do not use a solder gun and do not apply any force which would tend to push the copper away from the board.

## B. ACCESSIBILITY OF ADJUSTMENTS

1. All adjustments are accessible by removing the top and bottom shield covers as follows:

   a. Remove the four #4 binder head screws from the top cover and the upper two #4 binder head screws on each side. Gently remove cover. Removal of the cover gives access to all adjustments except C59, the mixer local oscillator series resonant coupling adjustment, which is accessible by removal of the bottom cover.

   b. Remove the two lower #4 binder head screws from each side; turn the unit upside down, remove the four #4 flat head screws from the bottom cover and remove cover. Note that flat head screws are required in the bottom cover and that the bottom cover is countersunk to receive them.

## C. CALIBRATION

1. Before making any adjustments, the Type 1340 must be supplied with power either from the Model 340 by means of an extension cable or by separate ± 15 volt supplies. The AGC control line (pin 3 P1 may be manually controlled by connecting to the center arm of a potentiometer connected across the + 15 volt supply (a 5K, 10 turn, 5 watt potentiometer is ideal).

2. 1.020 MHz calibrating signal: Remove the six #4 binder head screws holding the oscillator shield and remove shield. Using a low capacitance probe and high frequency oscilloscope, check the signal at terminal #3 of the 1.020 MHz oscillator module. Tune C36, accessible from the top of this module shield can for maximum output indication. Output waveform should be sinusodial, approximately 3 to 4 volts peak to peak and 1.020 MHz ± .1%. Connect probe to terminal #2 of the voltage controlled buffer/amplifier module. Tune C42, accessible from the top end of this module shield can for maximum output. Waveform should be clean, sinusodial and approximately 2.3 volts peak to peak when the BASE RESISTANCE switch S1 is turned fully clockwise to the 5K position. If a sensitive well shielded RF voltmeter is available, the calibrate level may be adjusted by R55 located at the top of the shielded calibrate signal adjust module to 170 microvolts at the emitter terminal of the test transistor socket or across the secondary of T1, the shielded calibration transformer.

3. 1.0 MHz AGC Amplifier: Two methods of alignment of the 1.0 MHz ACC amplifier will be described. Extreme care should be observed when aligning, or the necessary maximally flat bandpass shape will not result. Low capacitance measuring probes and accurate signal generator frequencies are required.

   a. Sweep Generator method:

      Apply power to the Type 1340 head as described in Section 4, par. C.1. Connect sweep generator centered at 1.000 MHz with ± 100 KHz deviation, 200 microvolt output level, in series with a 1000 ohm resistor to the collector pin of the test transistor socket. Remove both quartz crystals Y1 and Y2 from their sockets. Connect oscilloscope with low capacitance probe to terminal #6 of the frequency converter or mixer module. Set oscilloscope sweep for either single or double trace alignment method. Adjust oscilloscope sensitivity and manual AGC level to the Type 1340 head to obtain approximately 1 volt peak to peak oscilloscope deflection. Align capacitors C5, C10, C14, C18, C22 and C26 for a maximally flat bandpass shape with a minimum -2% bandwidth of 40 KHz and -3db bandwidth of approximately 120 KHz.

This one

b. Staggered Butterworth method:

Apply power to the Type 1340 head as described in Section 4 par. C.1. Connect a signal generator tuned to 0.939 MHz and 3 millivolt output level, in series with a 100C ohm resistor to the collector pin of the test transistor socket. Remove both quartz crystals Y1 and Y2 from their sockets. Connect a sensitive RF voltmeter via a low capacitance probe to terminal #3 of T3, the first 1.0 MHz AGC amplifier module. Apply approximately 5 milliamperes or 4 volts of manual AGC. Tune C5 for maximum meter indication (approximately 5 millivolts at 0.939 MHz). Remove RF voltmeter probe and connect to pin #3 of T5, the third 1.0 MHz AGC amplifier module. Reduce the signal generator level to maintain the 5 millivolt indication, but maintain the frequency at 0.939 MHz. Tune C14 for maximum meter indication, reducing the generator level as required. Connect voltmeter probe to terminal #3 of T7 the fifth 1.0 MHz amplifier module. Align C22 for maximum meter indication. Tune the signal generator to 1.061 MHz, connect meter probe to terminal #3 of T4 the second 1.0 MHz AGC amplifier module. Align C10 for maximum meter indication adjusting the signal generator level as required to maintain the level around 5 millivolts. Move meter probe to terminal #3 of T6 the fourth 1.0 MHz AGC amplifier module. Align C18 for maximum meter indication as before. Connect meter probe to terminal #6 of the converter or mixer module, reduce sensitivity of the RF voltmeter as necessary to obtain an on scale reading. It will be unnecessary to reduce the signal generator output level unless the voltmeter level exceeds 0.3 volts. With the voltmeter still connected to terminal #6 of the mixer, tune the signal generator ± 100 KHz around 1.000 MHz and observe the AGC amplifier bandpass shape. Bandpass shape should be flat ± 2% for 20 KHz each side of 1.000 MHz and the -3db total bandwidth approximately 120 KHz. Replace both Quartz crystals to their proper holders, 1.020 MHz is the calibrate oscillator and 1.000 MHz the local oscillator.

4. 1.000 MHz Local Oscillator: With power applied as in Section 4 par. C.1. connect a low capacitance oscilloscope probe to terminal #3 of the local crystal oscillator module. Tune C49 for maximum deflection. The waveform should be clean, sinusodial and approximately 3 to 4v peak to peak. Connect oscilloscope probe to terminal #2 of the local oscillator buffer/amplifier module. Adjust C55 for maximum deflection, Replace the shield covering the oscillator terminal sections, being careful of cables and wiring. Connect oscilloscope

probe to terminal #5 of the converter or mixer module. Adjust C59 for a maximum oscilloscope indication. Some clipping of the positive wave halves will be observed. The distortion is normal.

5. Frequency Converter or Mixer: Place a small 1000 ohm carbon resistor between emitter and collector of the test transistor socket. If power is being supplied from the Model 340 turn the collector voltage control to zero. A wave analyzer connected to the noise output pin #1, P1, should indicate a calibrate signal between 19.5 KHz and 20.5 KHz. Place the BASE RESISTANCE switch in the 5K position and adjust the manual AGC level to obtain 0.10 volt 20 KHz signal at the converter output, pin #1, P1. Switch BASE RESISTANCE to the 50 ohm position. The 20 KHz calibrate signal should drop to 0.01 volts; if not, adjust R62. Switch the BASE RESISTANCE switch progressively to 100 ohm, 200 ohm, 500 ohm 1K and 2K positions. The 20 KHz calibrate signal should indicate 0.014, 0.020, 0.0316, 0.0446 and 0.0663 volts respectively; if not, adjust in sequence R61, R60, R59, R58 and R57.

6. Calibration level: Alternate methods of determining the calibrate signal level are as follows: (see also Section 4, C.2.)

   a. Connect an accurate signal generator in series with a small 1000 ohm carbon resistor to the test transistor collector terminal and ground. Remove the 1.020 MHz quartz crystal Y1 and adjust the signal generator to 1.020 MHz and 170 microvolts output. Adjust the manual AGC control for 0.25v RMS 20 KHz signal at the converter output pin #1,P1. Remove the signal generator and place the 1000 ohm resistor between collector and emitter terminals of the test transistor socket. Set BASE RESISTANCE switch fully clockwise to the 5K position. Insert the 1.020 MHz crystal and set calibrate level adjust R55 to obtain 0.25v RMS, 20 KHz signal at converter output pin 1, P1. Make sure the AGC is not changed during this transfer process.

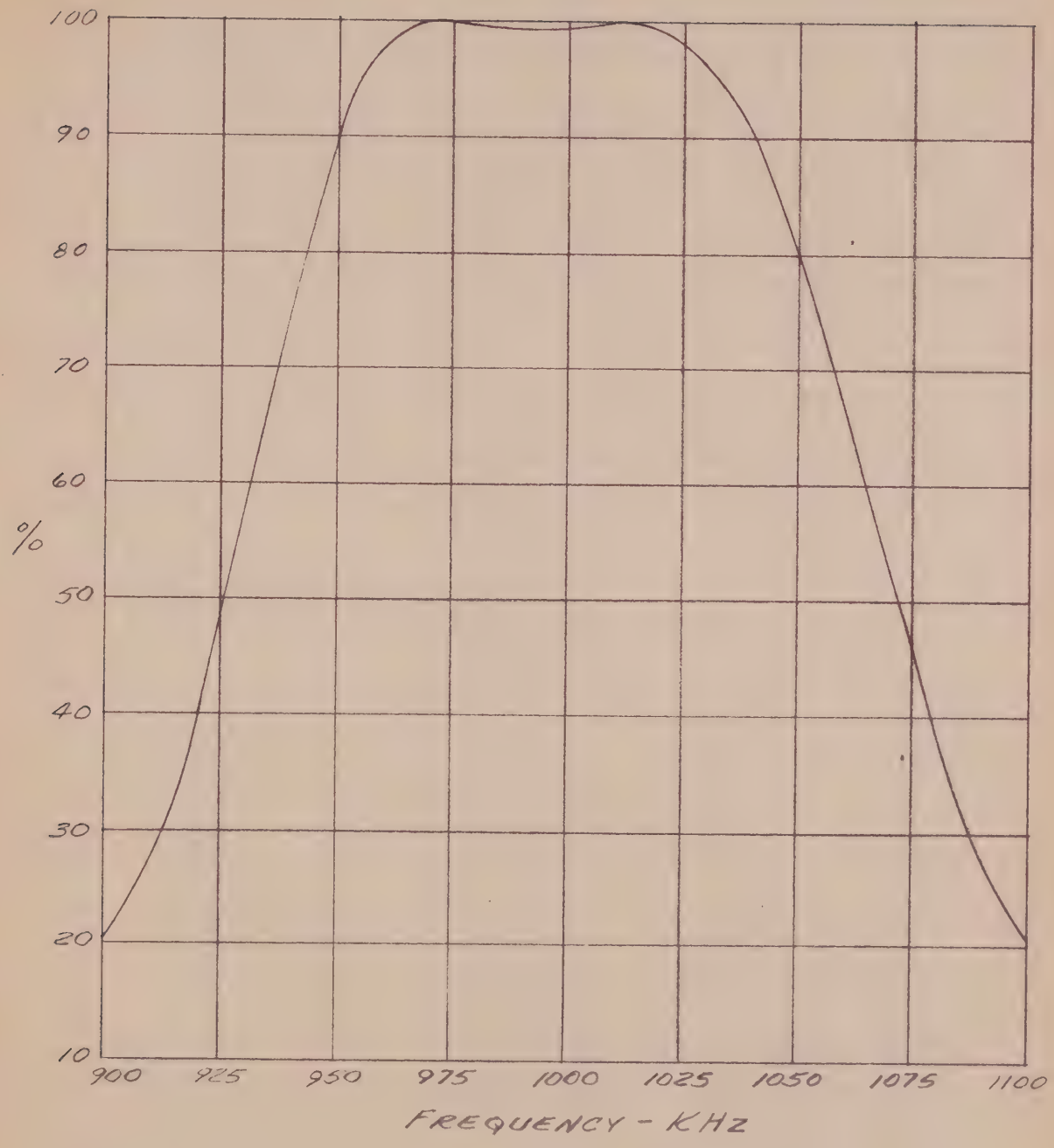
   b. The following method requires the Type 1340 head be connected to the Model 340 directly or by extension cable and requires an accurate random noise generator at 1.0 MHz. Insert a low noise figure transistor in the test jig socket, set operating parameters for minimum noise with BASE RESISTANCE switch in 50 ohm position. Connect the noise generator between base of the test transistor and ground. Set the noise generator level to $9.1 \times 10^{-9}$ volts in one Hz of bandwidth across the base resistor. Set calibrate signal level adjust R55 for a noise figure indication on the Model 340 of 20db.

9.1 X 100 600Ω TERM

V - 2V

C - .02ma

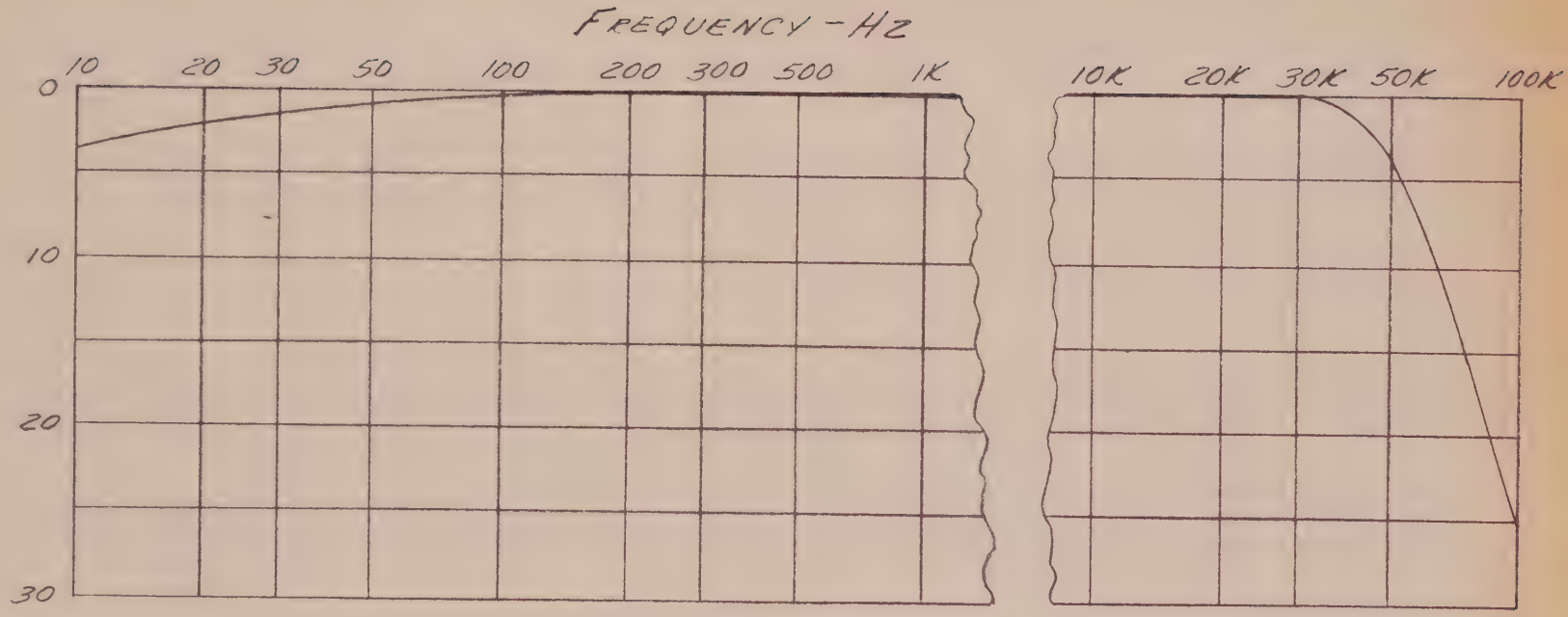
Note: It is necessary that the noise generator be DC isolated from the transistor base to allow normal bias voltages for the test transistor. Note also that the Model 340 be previously calibrated.




TYPICAL BAND PASS RESPONSE
1.0 MHz AGC AMPLIFIER

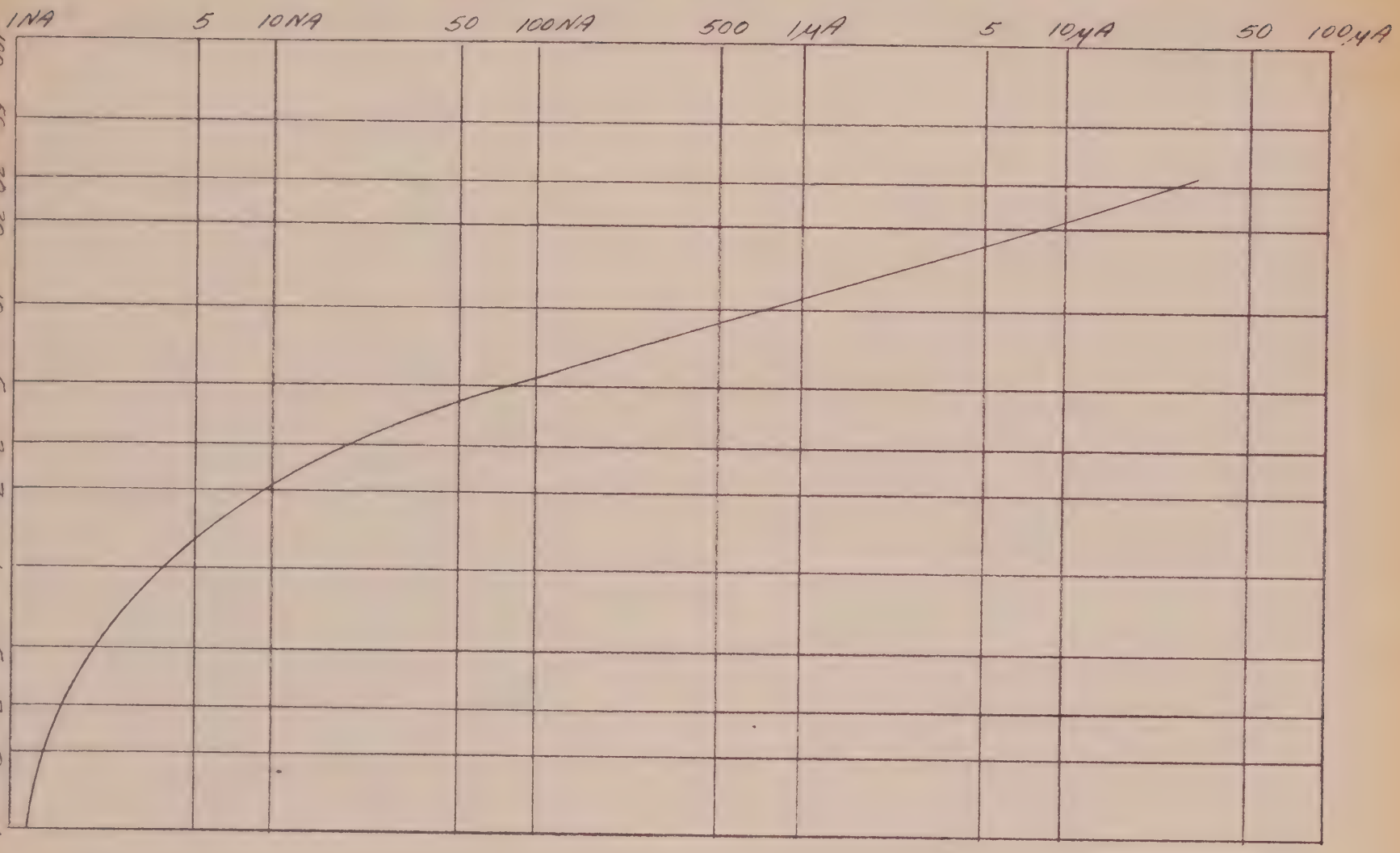
TYPE 1300
1.0 MHz

TYPE 1340
1.0 MHz
10.7 MHz
45 MHz



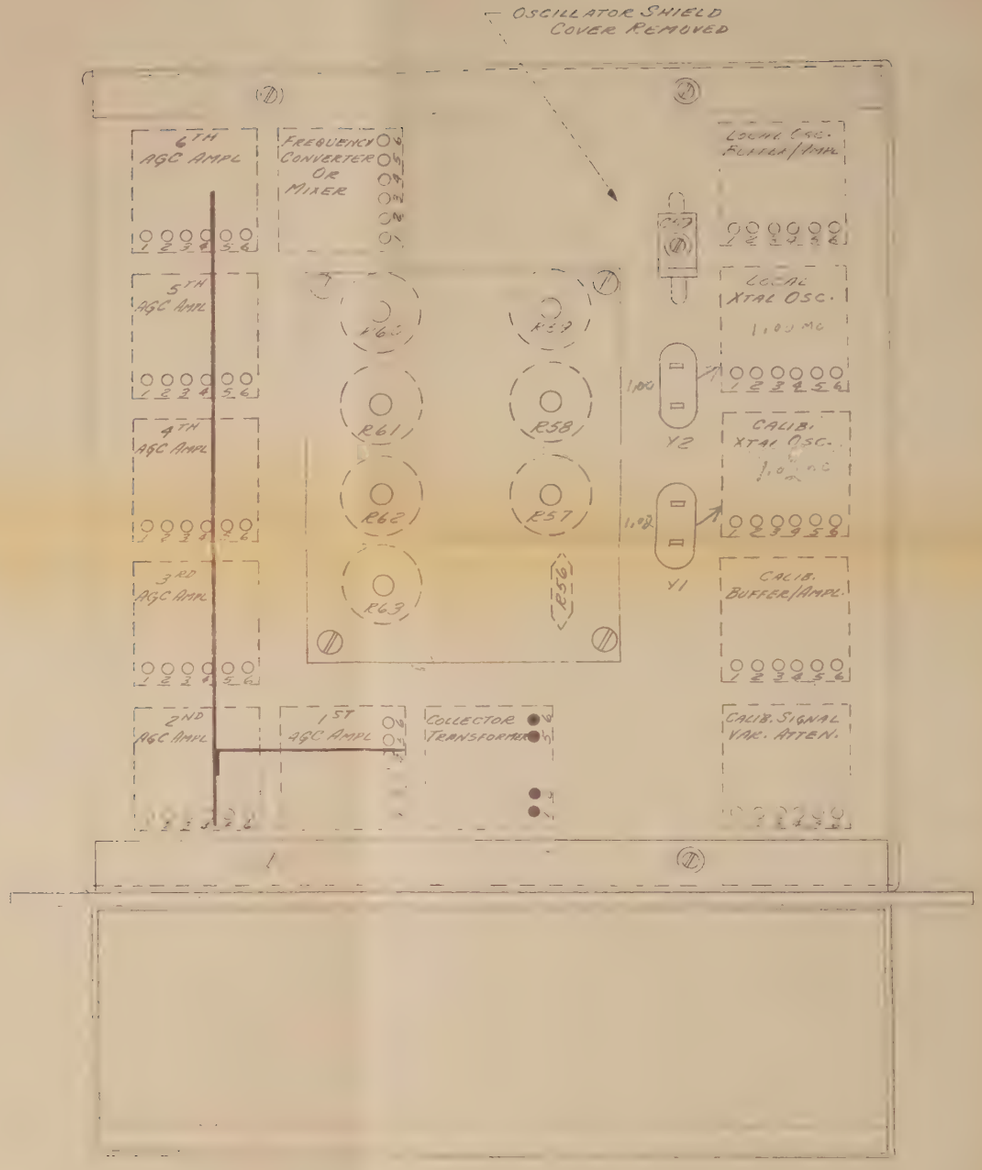

TYPICAL LOW PASS FILTER RESPONSE

T2 1.0 MHz INPUT CURRENT FOR 0.25V. 20KHz AT OUTPUT PIN #1, D1




TYPICAL AGC GAIN PLOT

A. Top View
Top Cover Removed




B. Bottom View
Bottom Cover Removed

# LOCATION AND IDENTIFICATION OF ADJUSTMENTS TYPE 1340 1.0 MHz

.0000000.91

# SEMICONDUCTOR LEGEND

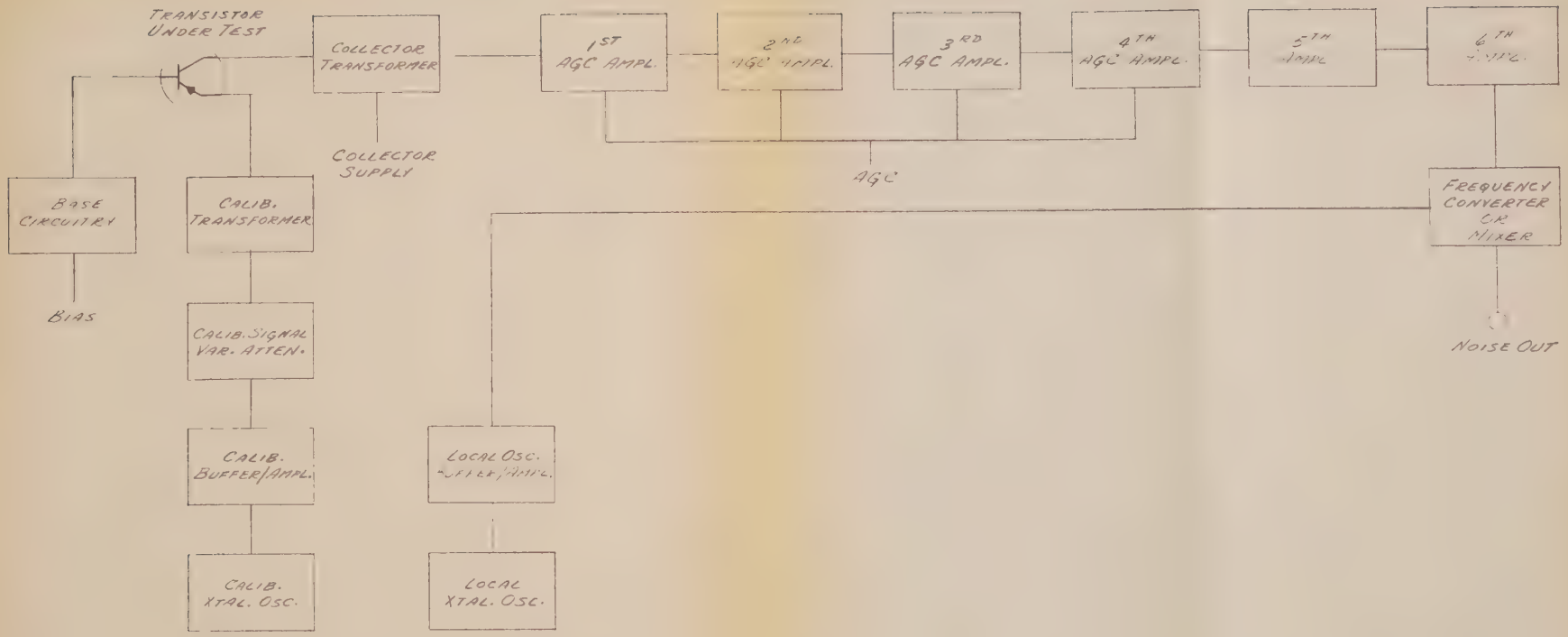
Changes and improvements in the semiconductor products available for commercial use necessitate type changes from time to time. To eliminate confusion and costly paperwork, many of these changes will be covered in the following legend. The purpose of this legend is to acknowledge the fact that the type number on a semiconductor found in a piece of equipment will not necessarily correspond with the type number given on the schematic diagram.

The legend is not intended to be an interchangeability list although in many cases good quality components* within a given category may be substituted with acceptable results. Normally, replacements should be made using components having the same type number as the component being replaced.

Those components bearing an asterisk on the schematic diagram are factory selected components and should be obtained from Quan-Tech Laboratories.

*It should be noted that the incoming inspection procedure followed at Quan-Tech Laboratories includes noise screening on most semiconductors.

| TYPE # ON SCHEMATIC | TYPE # IN EQUIPMENT |
|---|---|
| T1480 | 2N1613 |
| T1494 | 2N1613 |
| 1N703 | 1N748 |
| 1N709 | 1N753 |
| 1N2859 | 1N3253, 1N3254 |
| 1N2862 | 1N3254 |
| 2N396A | 4JX1G759, 4JX1D653, 2N3644 |
| 2N414 | 2N396A, 4JX1G759, 4JX1D653, 2N3644 |
| 2N929 | 220N2, A642, 2N3566, A322, A324 |
| 2N1515 | 2N3644 |
| 2N1613 | 2N3566 |
| 2N2219 | 220N2, A642, 2N3566, A322, A324 |
| 2N2603 | 2N3250 |
| 2N3250 | 2N3644 |
| 2N270 | 2N3644 |
| 2N1306 | 2N3566 |
| 2N1304 | 2N3566 |




BLOCK DIAGRAM
PLUG-IN UNIT
TYPE 1340
1.0 MHz AND 10.7 MHz

B-5352-B

SCHEMATIC
1.0 MHz
TYPE 1340

D-0393-E

# Quan-Tech LABORATORIES, INC.

INSTRUMENTS • AMPLIFIERS • NOISE INSTRUMENTATION

*SHORT FORM CATALOG*

# A Word About Noise Analysis

Since 1957 when it was founded, Quan-Tech Laboratories has specialized in the amplification and measurement of extremely low level signals approaching the theoretical limits of sensitivity. In order to build equipment of this sort it was necessary to select components having the lowest possible electrical noise for use in the most sensitive parts of the circuit. Noisier components were relegated to places where (it was thought) their noise would not interfere with proper operation. These noisy components exhibited a very high rate of failure compared to the quiet ones, so an intensive study of the reasons for these failures was undertaken.

Investigation showed that those components which exhibited excessive amounts of noise (particularly of the "1/f" type) compared to similar units, usually contained some defect or abnormality which could lead to early failure. This was equally true of resistors, transistors, and diodes, even though the failure mechanism might be different for each device.

This discovery led to the development of specific electrical noise measuring instruments for each type of component. Cooperative programs with manufacturers have proved beyond doubt that noise measurements, properly applied, can locate many types of failure-prone components before they are placed in the circuit, with resultant cost saving and increased reliability. Even manufacturers of such fiercely competitive items as automobile radios, electronic organs, and hearing aids have found noise screening cuts costs and improves product quality.

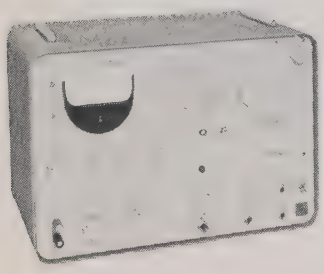
If you haven't already investigated the benefits of noise analysis, both for reliability and for very low noise applications, why not contact us or our local representative and get the full story?

Quan-Tech LABORATORIES, INC.

**Quan-Tech LABORATORIES, INC.**

# WAVE AND SPECTRUM ANALYZERS

*ACCURATE • VERSATILE • RELIABLE • PORTABLE • FIVE INSTRUMENTS*
*1 Hz to 200 KHz • ALL SOLID STATE*



## Model 304

**LOW FREQUENCY WAVE & SPECTRUM ANALYZER**

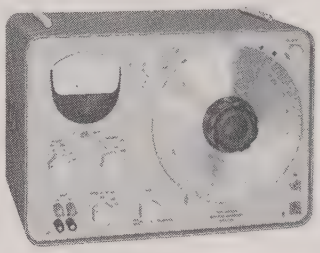
**Frequency range:** 1 Hz to 5 KHz; **Bandpasses:** 1, 10 & 100 Hz, selectable at front panel; **skirt selectivity:** 24 db per ½ bandwidth; **Voltage range:** 30 $\mu$V to 100 V, FS; down to .03 $\mu$V, FS, with accessory Model 206B preamplifier (see last page); **Tuning:** Manual or automatic; Internally supplied electronic sweep of total frequency range or of discrete portions; provision for external sweep; **Frequency calibration:** Linear 1 Hz per division; **Outputs:** BFO, restored signal, sample of automatic sweep, analogs of meter reading and frequency setting, phase output for phase plot on X-Y recorder. **Price:** $2450.

**OPTIONAL FEATURES**

Pen lift; AFC; Log, squared, or RMS meter reading; slave operation for multi-channel analyzer system. **Prices:** Upon request

**WAVE AND SPECTRUM ANALYZER** **Model 305**

Similar to Model 304 except: **Frequency Range:** 10 Hz to 50 KHz. **Bandpasses:** 10, 100, and 1000 Hz and broadband, 10 Hz to 65 KHz. Also includes AFC, tracking filter operation, and built-in master-slave capability for multi-channel analyzer systems. **Price:** Upon request



## Model 303

**WAVE AND SPECTRUM ANALYZER**

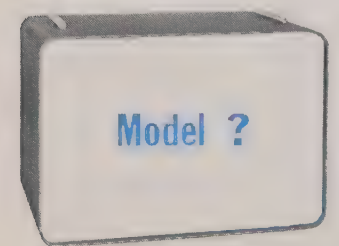
**Frequency range:** 30 Hz to 100 KHz. **Bandpasses:** 10, 30, 100, 1000 Hz, selectable at front panel. (100 and 1000 Hz bandwidths flat-topped for simplified noise computation, greater accuracy and convenient tuning. **Sensitivity:** 100 $\mu$V to 300 V, FS. Down to 1 $\mu$V FS with accessory Model 203 preamplifier (see last page). ± 300 Hz vernier; selection of long or short meter time constants; metering circuits compensated to minimize error from instantaneous noise pulses; overload-protected meter; analog output for external monitoring. **Price:** $1550.

**WAVE AND SPECTRUM ANALYZER** **Model 2156**

Similar to above except: **Frequency range:** 10 Hz to 30 KHz. **Bandpasses:** 3, 10, 30, 300 Hz. **Price:** $2150.

**WAVE AND SPECTRUM ANALYZER** **Model 2223**

Similar to above except: **Frequency range:** 10 Hz to 200 KHz. **Bandpasses:** 10, 100, 750, 1000 Hz. **Price:** Upon request.




## Have we left you out?

While the analyzers listed above cover the great majority of applications, special requirements can often be met by a modification or minor redesign of an existing instrument. Let us know your problem and we'll see if we can't help solve it.

All prices shown are F.O.B. Whippany, N. J. Prices and specifications subject to change without notice.

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**Quan-Tech LABORATORIES, INC.**

# TRANSISTOR NOISE ANALYZERS

### R.F. TRANSISTOR NOISE ANALYZER

Measures noise figure directly of transistors and FET's at radio frequencies. Plug-in heads available for test frequencies between 1 MHz and 60 MHz. **Noise figure range:** 0 to 40 db. **Base resistance range:** 50, 100, 200, 500, 1K, 2K, 5K ohms. **Collector voltage range:** ±1 to 30 volts. **Collector current range:** 30 μa to 30 ma. **Price:** $2200.

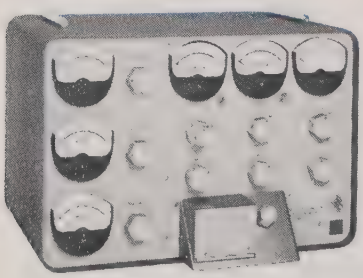
Heads available from $1250 up.

## Model 340

### TRANSISTOR NOISE ANALYZER

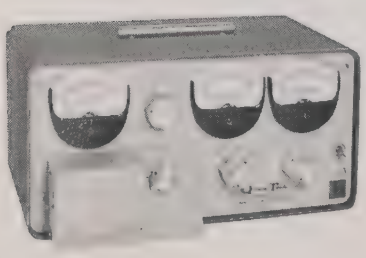
The most versatile unit available. Measures noise current and voltage at 10 and 100 Hz, 1, 10, and 100 KHz simultaneously. **Noise spectral density range:** 3 to 3000 nanovolts FS. **Base resistance range:** 0, 500, 1K, 10K, 100K, and 1M ohms plus external position. **Collector voltage range:** 0.3 to 60 volts. **Collector current range:** 0.3 μa to 30 ma. Also measures FET's. **Price:** $4995.

## Model 2173C -2181



## Model 310 TRANSISTOR NOISE ANALYZER

Measures noise current and voltage at 100 Hz, 1 KHz and 10 KHz as well as $1_{cbo}$, $1_{ebo}$ and beta. **Noise spectral density range:** 0.01 to 3 μV, FS. 1 to 300 pa, FS. **Collector current range:** 0.05 to 30 ma. **Collector voltage range:** 0.1 to 30 V. **Base resistance range:** 0, 500, 1K, 10K plus external position. **Price:**$2475.



## Model 311 TRANSISTOR NOISE ANALYZER

Similar to above, except that collector current range is from 5 to 1000 μa for noise measurement in low-collector-current devices. Measures Gm instead of beta. Also measures FET's. **Price:**$2675.

## Model 512 TRANSISTOR NOISE TEST SET

Measures broadband noise figure directly in db. **Noise bandwidth:** 15.7 KHz (—3 db at 10 Hz and 10 KHz). **Noise figure range:** 0 to62 db. **Collector voltage range;** ±3 to 30 volts. **Collector current range:** 10 μa to 1 ma. **Base resistance range:** 50, 500, 1K, 10K ohms plus external position. Also measures FET's **Price:**$1250.

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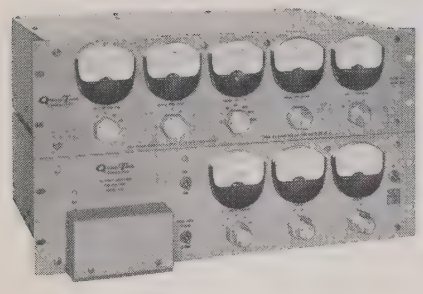
# Quan-Tech LABORATORIES, INC.

- INTEGRATED CIRCUIT NOISE ANALYZERS
- RESISTOR & DIODE NOISE ANALYZERS
- SPECIAL INSTRUMENTS & SYSTEMS



## Model 2283
## Model 2181

### INTEGRATED CIRCUIT NOISE ANALYZER

This extremely versatile noise measuring system was designed primarily for measuring noise in linear IC's and Op Amps. Simple plug-in PC cards enable it also to measure discrete components such as resistors, zener diodes, bipolar and FET's. Bias voltages: + and −12V fixed, + and −0 to 30V independently variable at 100 ma. Noise spectral density: 3 to 3000 nanovolts. Filter frequencies: 10 and 100 Hz, 1, 10, and 100 KHz measured simultaneously.

**Price:** Model 2283 Control Unit $1450.
Model 2181 Filter Unit $2500.

### INTEGRATED CIRCUIT TEST SYSTEMS

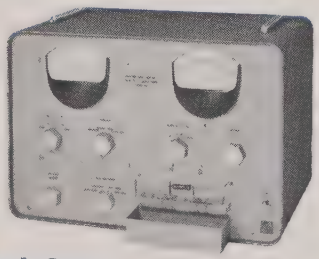
On special order Quan-Tech can supply systems for measuring not only noise in IC's, but many other AC and DC parameters as well, such as DC offset voltage and current, differential DC offsets, open loop gain, etc. Readings are automatically sequenced, digitized, and stored, with optical readout and provision for printed or punch-card data storage.

## Special Instruments

Quan-Tech manufactures a great many "specials", ranging from one unit only to production quantities on an OEM basis. Our engineering department is extremely flexible and equipped to handle anything from minor modifications of standard instruments to the design and construction of an extremely complicated fully automatic noise measuring system. We are proud of our ability to meet difficult specifications that challenge the state of the art for low noise, stability, and accuracy. Your inquiry will receive a prompt reply.

## Special Systems

A typical example of a large system designed exclusively for an individual customer's requirements is the **Model 5002,** built for Western Electric. The system has forty channels for detecting insulation breakdown or corona discharge in up to forty reels of transoceanic telephone cable during extended voltage breakdown tests. If any cable emits a noise pulse exceeding a preset level, a digital printer automatically prints out the cable number, test condition, time, and date.



## Model 315

### RESISTOR NOISE TEST SET

Measures noise in resistors in conformance with specifications recommended by NBS and Method 308 of MIL STD 202B. **Test-resistor range:** 100Ω to 22 meg Ω. **Measurement range:** 0.6 μV in a decade to 1000 μV in a decade. **Outputs:** Sample of noise voltage; analogs of meter readings. External cable supplied for remote location of test jig. **Price:** $2150.

### MODEL 2136

Similar to above, but measures resistors down to 10 Ω. **Price:** $2300.

## Model 327

### DIODE NOISE ANALYZER

Measures noise in back-biased semi-conductor diodes at 10 Hz and 1 KHz simultaneously. **Noise spectral density range:** 0.03 μV to 1 mV. **Test Voltage:** 0 to 500 V, continuously variable. **Test current:** 0 to 100 ma, continuously variable. Internally supplied ramp automatically sweeps test current and/or voltage within maximum ratings. A wide variety of outputs for data logging, external monitoring, actuating external equipment, etc. **Price:** $2750.

### TYPE 1115 JIG AND TRANSFORMER

For measuring noise in forward-biased diodes up to 100 ma. **Price:** $300.

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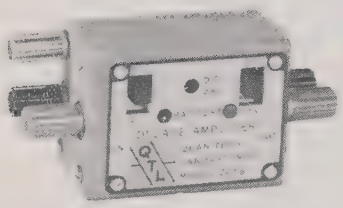
# Quan-Tech LABORATORIES, INC.

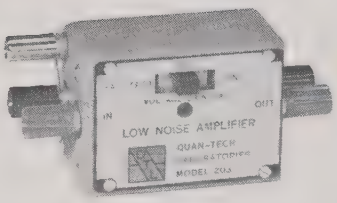
- SOLID STATE AMPLIFIERS
- AMPLITUDE DISTRIBUTION ANALYZER
- RANDOM NOISE GENERATOR



## Model 201B

**DC DECADE AMPLIFIER AC OR DC COUPLED**

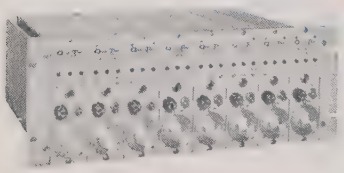
**Bandwidth:** DC or 10 Hz to 3 MHz (3 db); **Gain:** 10 (fixed); Power: Self-contained batteries; 600 hour life. **Price:** $110.




## Model 203

**LOW NOISE AC AMPLIFIER**

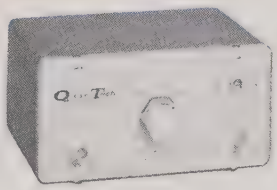
**Bandwidth:** 30 Hz to 100 KHz (± 0.5 db); —3 db at 500 KHz; **Gain:** 100 (fixed); **Typical noise spectral density:** 5 x $10^{-9}$ V and 3 x $10^{-12}$ A at 1 KHz. Battery powered. **Price:** $125.



## Model 2220

**INSTRUMENTATION AMPLIFIER**

Modular amplifiers mount 8 units in a 7″ rack panel. **Voltage gain:** 0 to 80 db in 5 db steps. **Controlled frequency characteristics:** (selected by plug-in cards) voltage gain flat 10 Hz to 100 KHz or 10 Hz to 20 KHz, rising 3 db/octave 10 Hz to 100 KHz or 6 db/octave 10 Hz to 20 KHz. **Price:** $590.



## Model 206B

**SELECTABLE GAIN AC AMPLIFIER**

**Bandwidth:** 1 Hz to 100 KHz (within 0.5 db); —3 db at 500 KHz. **Typical noise spectral density:** 5 x $10^{-9}$ V and 3 x $10^{-12}$ A at 1 KHz. **Gain:** 10, 100, & 1000, selectable at front panel; **Power:** 105-125 V AC or optional self-contained battery pack (automatically recharging). **Price:** $175. Batteries $25.

## Model 317

**AMPLITUDE DISTRIBUTION ANALYZER**

Determines amplitude-probability distribution of random signals. **Amplifier response:** 3 db down at approx. 12 Hz and 1 MHz; **Switching rate:** 5 MHz. **Amplitude ranges:** 100%, 10%, 1% FS; Normal or "inverted" operation; provision for external sweep of level. **Price:** $450.

## Model 420

**RANDOM NOISE GENERATOR**

Stable "white" noise output having true gaussian amplitude distribution. **Frequency range:** DC to 100 KHz; **Output spectral density:** 0.01 to 1000 $\mu$V, continuously variable, calibrated; **DC offset:** less than 10 mV at max. output. **Price:** $550.

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# Representatives List

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Belmont, Mass. 02178
617-489-1400

P.O. Box 87
Milford, Conn. 06460
203-TR 4-2112

### New York State

LINDGREN ASSOCIATES
605 Palmer Drive
No. Syracuse, N. Y. 13212
315-GL 8-3113

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Andalusia, Pa. 19020
215-639-3100

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Cleveland, Ohio 44130
216-842-2737

11820 Knollsprings Court
Cincinnati, Ohio 45246
513-825-8686

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Orlando, Fla. 32801
305-424-9983
305-424-5328

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Winston-Salem, N. C. 27101
919-722-9671

900 Bob Wallace Ave.
Huntsville, Ala. 35801
205-534-2811

6431 Highgate Lane
Dallas, Texas 75214
214-EM 1-5346

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Denver, Colorado 80210
303-756-2046

### Washington, Oregon

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4110 Stone Way N.
Seattle, Washington 98103
206-ME 2-1618

### Northern California

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Los Altos, Calif. 94022
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### Southern California, Arizona

A-F SALES ENGINEERING INC.
94 So. Los Robles Ave.
Pasadena, Calif. 91101
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213-SY 5-7081

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ATLAS INSTRUMENT CORP.
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416-781-6174

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Montreal, Quebec
514-HU 9-8495

342½ Elgin St.
Ottawa, Ontario
613-CE 3-9471

10204- 88th St.
Edmonton, Alberta
403-424-9065

### ALL Export (Except Canada)

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72 West 45th Street
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212-MU 7-3213

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